

I claim:

1. A latch assembly, comprising:
a ratchet having latched and unlatched positions;
a pawl releasably engagable with the ratchet to releasably retain the ratchet in its latched position; and
a lever movable to two different positions with respect to the pawl, the lever having a pivot point about which the lever pivots in both of the two different positions, the pivot point having substantially the same location with respect to the lever in both of the two different positions,
the lever pivotable about the pivot point in a first of the two different positions of the lever to move the pawl and to disengage the ratchet, the lever incapable of moving the pawl sufficiently to disengage the ratchet in a second of the two different positions of the lever.
2. The latch assembly as claimed in claim 1, wherein:
→ the lever is movable to additional positions with respect to the pawl in which the lever is pivotable about the pivot point; and
the pivot point is in substantially the same location with respect to the lever in the two different positions and in at least some of the additional positions.
3. The latch assembly as claimed in claim 1, wherein the lever is movable to additional positions with respect to the pawl, the lever pivotable to move the pawl and to disengage the ratchet in at least some of the additional positions.
4. The latch assembly as claimed in claim 3, wherein:
the lever is pivotable about the pivot point in at least some of the additional positions; and
the pivot point is in substantially the same location with respect to the lever in the two different positions and in at least some of the additional positions.
5. The latch assembly as claimed in claim 1, wherein the lever transmits no motive force to the pawl in the second of the two different positions of the lever.

6. The latch assembly as claimed in claim 1, wherein the lever is translatable to the two different positions with respect to the pawl.

7. The latch assembly as claimed in claim 1, wherein the lever is rotatable to the two different positions with respect to the pawl.

8. The latch assembly as claimed in claim 1, wherein the lever is movable to the two different positions with respect to the pawl by a combination of rotation and translation of the lever.

9. The latch assembly as claimed in claim 1, wherein the lever is located a closer distance to the pawl in the first position than in the second position.

10. The latch assembly as claimed in claim 1, further comprising a rotatable element coupled to the lever, the lever movable to the two different positions by rotation of the rotatable element.

11. The latch assembly as claimed in claim 10, wherein the rotatable element is disc-shaped.

12. The latch assembly as claimed in claim 10, wherein the lever is directly coupled to the rotatable element.

13. The latch assembly as claimed in claim 10, wherein the lever is coupled to the rotatable element by a link.

14. The latch assembly as claimed in claim 10, wherein the lever is coupled to the rotatable element via a pin and aperture connection permitting relative rotation between the rotatable element and the lever.

15. The latch assembly as claimed in claim 10, wherein the lever is movable by camming action against the lever responsive to rotation of the rotatable element.

camming
action
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elements

16. The latch assembly as claimed in claim 10, further comprising an over-center device coupled to the lever, the lever movable by actuation of the over-center device.

17. A method of operating a latch assembly, comprising:
providing a pawl releasably engaged with a ratchet;
pivoting a lever through a first path about a pivot point substantially fixed with respect to the lever, the lever incapable of transferring sufficient motive force to release the ratchet by pivoting through the first path;
moving the lever to move the pivot point to a different location with respect to the pawl;
pivoting the lever through a second path about the pivot point;
transferring motive force from the lever to the pawl by pivoting the lever through the second path; and
releasing the pawl from engagement with the ratchet by transferring motive force from the lever to the pawl.

18. The method as claimed in claim 17, wherein moving the lever includes moving the pivot through at least one other location in which the lever is pivotable about the pivot point.

19. The method as claimed in claim 18, wherein the lever is pivotable in the at least one other location to transfer motive force from the lever to the pawl and to release the pawl.

20. The method as claimed in claim 17, wherein pivoting the lever through the second path occurs during movement of the lever to move the pivot point to the different location with respect to the pawl.

21. The method as claimed in claim 17, wherein the lever transmits no motive force to release the ratchet when the lever is pivoted through the first path.

22. The method as claimed in claim 17, wherein moving the lever includes rotating the lever with respect to the pawl.

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23. The method as claimed in claim 17, wherein moving the lever includes translating the lever with respect to the pawl.

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24. The method as claimed in claim 17, wherein moving the lever includes translating and rotating the lever with respect to the pawl.

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25. The method as claimed in claim 17, wherein moving the lever includes moving the lever from a first position with respect to the pawl to a second position closer to the pawl.

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26. The method as claimed in claim 17, further comprising moving an element coupled to the lever to move the lever.

27. The method as claimed in claim 26, wherein the element is at least part of an over-center device coupled to the lever, the method further comprising actuating the over-center device from a first state, across a center position of the over-center device, and to a second state to move the lever.

28. The method as claimed in claim 26, wherein:
the element is rotatable with respect to the lever; and
the lever is moved responsive to rotation of the element.

29. A method of operating a latch assembly having a ratchet releasably engagable with a pawl, the method comprising:

pivoting a lever about a pivot point substantially fixed with respect to the lever and located in a first position with respect to a body of the latch apparatus, the lever incapable of exerting sufficient motive force to release the ratchet from engagement with the pawl when the pivot point is located in the first position;
moving the lever to move the pivot point away from the first position with respect to the body of the latch apparatus;
moving the lever to move the pivot point to a second position with respect to the body of

the latch apparatus; and
pivoting the lever about the pivot point in the second position;
moving the pawl with the lever to release the ratchet from engagement with the pawl
after moving the lever to move the pivot point away from the first position.

30. The method as claimed in claim 29, wherein moving the pawl occurs after the pivot point of the lever is moved to the second position.

31. The method as claimed in claim 29, wherein moving the pawl occurs while the lever is moved and while the lever is pivoted.

32. The method as claimed in claim 29, wherein moving the lever to move the pivot point to the second position includes translating the lever with respect to the pawl.

33. The method as claimed in claim 29, wherein the moving the lever to move the pivot point to the second position includes rotating the lever with respect to the pawl.

34. The method as claimed in claim 29, wherein moving the lever to move the pivot point to the second position includes translating and rotating the lever with respect to the pawl.

35. The method as claimed in claim 29, further comprising:
providing an actuator coupled to the lever; and
actuating the actuator to move the lever.

36. The method as claimed in claim 29, further comprising an over-center device coupled to the lever, the over-center device movable between two stable positions corresponding to the first and second positions of the pivot point.

37. A latch assembly, comprising:
a pawl movable between latched and unlatched positions;
a first lever pivotable about a pivot; and
a second lever coupled to the first lever and movable between locked and unlocked positions, the first lever having locked and unlocked positions corresponding to the locked and unlocked positions of the second lever; and
the first lever having a mass that is extended toward and adjacent to the pawl in the unlocked position of the first lever and is withdrawn and disposed a distance away from the pawl in the locked position of the first lever.

38. The latch assembly as claimed in claim 37, wherein the pivot of the first lever is located in substantially the same position with respect to the first lever in the locked and unlocked positions of the first lever.

39. The latch assembly as claimed in claim 37, wherein:
the first lever is incapable of sufficiently moving the pawl to unlatch the latch assembly when the first lever is in the unlocked position; and
the first lever is pivotable to a position in which movement of the second lever toward the unlocked position moves the pawl to release the latch assembly.

40. The latch assembly as claimed in claim 37, wherein the second lever is pivotable between the locked and unlocked positions of the second lever to move the mass of the first lever away from and toward the pawl, respectively.

41. The latch assembly as claimed in claim 40, wherein the second lever is pivotably coupled to the first lever.

42. The latch assembly as claimed in claim 37, wherein the second lever is pivotably coupled to the first lever.

43. The latch assembly as claimed in claim 37, wherein the second lever is coupled to a rotatable element, whereby rotation of the rotatable element moves the second lever between the locked and unlocked positions of the second lever.

44. The latch assembly as claimed in claim 43, wherein the second lever and the rotatable element at least partially define an over-center device having stable positions corresponding to the locked and unlocked positions of the first lever.

45. A method of operating a latch assembly, comprising:
moving a pawl to a first position in which the latch assembly is in a latched state;
actuating a lever having a mass located adjacent to the pawl to move the pawl to a second position in which the latch assembly is in an unlatched state;
returning the pawl to the first position;
moving the lever to a locked position;
withdrawing the mass of the lever to a position disposed a distance from the lever by moving the lever to the locked position; and
actuating the lever through a path of motion in which the mass of the lever is incapable of moving the pawl to the second position.

46. The method as claimed in claim 45, wherein both actuating steps include pivoting the lever about a pivot.

47. The method as claimed in claim 46, wherein the pivot is in substantially the same location with respect to the lever in both actuating steps.

48. The method as claimed in claim 45, wherein moving the lever to the locked position includes rotating the lever.

49. The method as claimed in claim 45, wherein moving the lever to the locked position includes translating the lever.

50. The method as claimed in claim 45, wherein moving the lever to the locked position includes translating and rotating the lever.

51. The method as claimed in claim 45, further comprising moving an over-center device from a first stable state of the over-center device to a second stable state of the over-center device during movement of the lever to the locked position.

52. The method as claimed in claim 51, wherein moving the over-center device includes rotating an element of the over-center device to move the over-center device from the first stable state toward the second stable state.

53. The method as claimed in claim 51, wherein:
the over-center device includes two elements rotatably coupled to one another; and
moving the over-center device includes rotating one element of the over-center device with respect to the lever and with respect to another element of the over-center device.

54. The method as claimed in claim 45, further comprising:
moving the lever to an unlocked position while the lever is at least partially actuated through the path of motion in which the mass of the lever is incapable of moving the pawl to the second position; and
moving the pawl to the second position responsive to moving the lever to the unlocked position.

55. The method as claimed in claim 45, wherein the lever does not contact the pawl in the path of motion of the lever.

56. A latch assembly, comprising:
a pawl having:
 an unlatched position; and
 a latched position;
a lever movable with respect to the pawl;
a rotatable member coupled to the lever and mounted for rotation about an axis, wherein
the lever is movable by rotation of the rotatable member coupled thereto, the
rotatable member rotatable between:
 a first position in which the lever is actuatable to move the pawl to the
 unlatched position; and
 a second position in which actuation of the lever is incapable of generating
 movement of the pawl to the unlatched position.
57. The latch assembly as claimed in claim 56, wherein the lever is movable between an
unlocked position and a locked position corresponding to the first and second positions of the
rotatable member, respectively, the lever pivotable about substantially the same location with
respect to the lever in the unlocked and locked positions.
58. The latch assembly as claimed in claim 56, wherein:
the rotatable member is a first rotatable member; and
the lever is coupled to the rotatable member by a second rotatable member coupled to
the lever and to the first rotatable member.
59. The latch assembly as claimed in claim 58, wherein:
first and second connections are defined between the lever and the second rotatable
member and between the second rotatable member and the first rotatable member,
respectively; and
at least one of the first and second connections is a lost-motion connection.
60. The latch assembly as claimed in claim 56, wherein the rotatable member is part of an
over-center device coupled to the lever.

61. The latch assembly as claimed in claim 56, wherein the lever is rotatably coupled to the rotatable member.

62. The latch assembly as claimed in claim 56, wherein the lever is located closer to the pawl in the first position than in the second position.

63. The latch assembly as claimed in claim 62, wherein the lever is located adjacent to an extension of the pawl in the first position and is located farther away from the extension of the pawl in the second position.

64. The latch assembly as claimed in claim 56, wherein:
the lever is coupled to a first end of the rotatable member; and
the rotatable member is rotatable about a second end opposite the first end.

65. The latch assembly as claimed in claim 56, wherein the first position of the rotatable member is one of a range of positions of the rotatable member in which the lever is actuatable to move the pawl to the unlatched position.

66. The latch assembly as claimed in claim 56, wherein the second position of the rotatable member is one of a range of positions of the rotatable member in which the lever is incapable of generating movement of the pawl to the unlatched position.

67. The latch assembly as claimed in claim 56, wherein the lever is incapable of moving the pawl in the second position of the rotatable member.

68. A method of operating a latch, comprising:
moving a pawl to a latched position;
providing a lever in a first position in which actuation of the lever is incapable of moving
the pawl to an unlatched position;
initiating rotation of a rotatable member about an axis thereof, the rotatable member
coupled to the lever;
rotating the rotatable member about the axis toward an unlocked position;
moving the lever from the first position to a second position by rotation of the rotatable
member toward the unlocked position;
actuating the lever after initiating rotation of the rotatable member; and
moving the pawl to the unlatched position by actuation of the lever.

69. The method as claimed in claim 68, wherein actuating the lever includes pivoting the
lever about a pivot point.

70. The method as claimed in claim 69, wherein the lever is pivotable about the pivot point in
the first and second positions of the lever, the pivot point located in substantially the same
location with respect to the lever in the first and second positions of the lever.

71. The method as claimed in claim 68, wherein the lever is actuated and the pawl is moved
to the unlatched position after the lever has been moved to the second position.

72. The method as claimed in claim 68, further comprising moving the pawl to the unlatched
position while moving the lever from the first position to the second position and while the lever
is at least partially actuated.

73. The method as claimed in claim 68, wherein the rotatable member is pivotably coupled to
the lever.

74. The method as claimed in claim 73, wherein the rotatable member is pivotably coupled to
the lever via a second rotatable member.

75. The method as claimed in claim 68, wherein the rotatable member is coupled to the lever by a lost-motion connection.

76. The method as claimed in claim 68, wherein moving the lever includes rotating the lever from the first position to the second position.

77. The method as claimed in claim 76, wherein moving the lever also includes rotating the lever with respect to the rotating member.

78. The method as claimed in claim 76, wherein moving the lever also includes rotating the lever with respect to the pawl.

79. The method as claimed in claim 68, wherein the first position is closer to the pawl than the second position.

80. The method as claimed in claim 68, wherein moving the pawl includes pushing the pawl with the lever.

81. A latch assembly, comprising:
a pawl movable between a latched position and an unlatched position;
a lever having
 at least one unlocked position in which the lever is actuatable to move the pawl to the unlatched position; and
 at least one locked position in which the lever is incapable of moving the pawl to the unlatched position;
an over-center device coupled to the lever, the over-center device having
 a first stable position in which the lever is moved by the over-center device with respect to the pawl to the unlocked position; and
 a second stable position in which the lever is moved by the over-center device with respect to the pawl to the locked position.

82. The latch assembly as claimed in claim 81, further comprising a ratchet releasably engagable with the pawl and having latched and unlatched positions corresponding to the latched and unlatched positions of the pawl.

83. The latch assembly as claimed in claim 81, wherein the lever is pivotably coupled to the over-center device at a pivot point.

84. The latch assembly as claimed in claim 83, wherein the pivot point is located in substantially the same location with respect to the lever in at least one unlocked position of the lever and in at least one locked position of the lever.

85. The latch assembly as claimed in claim 81, wherein the over-center device includes a first element and a second element pivotably coupled to one another at a first pivot point, the first element also coupled to the lever.

86. The latch assembly as claimed in claim 85, wherein the first element is pivotably coupled to the lever at a second pivot point.

87. The latch assembly as claimed in claim 86, wherein:
the second element has a third pivot point about which the second element is pivotable,
the third pivot point located a distance from the first pivot point; and

the first and second elements have first and second stable positions and an intermediate center position defined by different pivotal positions of the first element with respect to the second element, the center position further defined by a line extending through the second and third pivot points.

88. The latch assembly as claimed in claim 87, wherein the first and second stable positions are on opposite sides of the line.

89. The latch assembly as claimed in claim 85, wherein the first and second elements are pivotably coupled together by a lost-motion connection.

90. The latch assembly as claimed in claim 85, wherein:

the second element has a third pivot point about which the second element is pivotable, the third pivot point located a distance from the first pivot point,

the latch assembly further comprising an angle between a first line extending through the first and second pivot points and a second line extending through the first and third pivot points, the angle having different sizes defined by different relative positions of the first element with respect to the second element, the angle limited to acute angle sizes.

91. The latch assembly as claimed in claim 85, wherein:

the second element has a third pivot point about which the second element is pivotable, the third pivot point located a distance from the first pivot point,

the latch assembly further comprising an angle between a first line extending through the first and second pivot points and a second line extending through the first and third pivot points, the angle having different sizes defined by different relative positions of the first element with respect to the second element, the angle limited to obtuse angle sizes.

92. The latch assembly as claimed in claim 85, wherein the lever is movable to cam against the first element in the unlocked position of the lever.

93. The latch assembly as claimed in claim 85, wherein the lever is coupled to the first element by a pivot.

94. The latch assembly as claimed in claim 85, wherein at least one of the first and second elements has a rotational range limited by at least one stop in at least one of the locked and unlocked positions of the over-center device.

95. The latch assembly as claimed in claim 85, wherein the first and second elements are rotatable through respective ranges of positions limited only by a range of movement of the lever.

96. The latch assembly as claimed in claim 81, wherein the over-center device includes first and second elements movable with respect to one another, the first element coupled to the lever and positioned to ride upon a surface of the second element that is inclined with respect to the first element.

97. The latch assembly as claimed in claim 81, wherein the over-center device includes first and second elements movable with respect to one another, the second element rotatable about a pivot point, the first element coupled to the lever and positioned to ride upon a surface of the first element.

98. A method of operating a latch assembly, comprising:

providing a lever coupled to a pawl and movable with respect to the pawl, the lever having a first position with respect to the pawl in which actuation of the lever is incapable of moving the pawl sufficiently to unlatch the latch assembly;

moving an over-center device coupled to the lever from a first stable position toward a center position;

moving the over-center device past the center position toward a second stable position;

moving the lever from the first position with respect to the pawl to a second position with respect to the pawl responsive to movement of the over-center device;

actuating the lever in the second position; and

moving the pawl to unlatch the latch assembly responsive to actuation of the lever in the second position.

99. The method as claimed in claim 98, wherein the lever is moved from the first position with respect to the pawl to the second position with respect to the pawl during movement of the over-center device from the first stable position toward the center position.

100. The method as claimed in claim 98, wherein the lever is moved from the first position with respect to the pawl to the second position with respect to the pawl during movement of the over-center device past the center position toward the second stable position.

101. The method as claimed in claim 98, wherein the over-center device includes first and second elements rotatably coupled to one another, the second element also coupled to the lever, the method further comprising:

rotating the first element of the over-center device;

rotating the second element of the over-center device responsive to rotation of the first element; and

moving the lever responsive to rotating the second element of the over-center device coupled to the lever.

102. The method as claimed in claim 101, further comprising stopping rotation of at least one of the first and second elements of the over-center device by a stop, the over-center device in the first stable position when the at least one of the first and second elements is stopped by the stop.

103. The method as claimed in claim 101, further comprising stopping rotation of at least one of the first and second elements of the over-center device by a stop, the over-center device in the second stable position when the at least one of the first and second elements is stopped by the stop.

104. The method as claimed in claim 98, wherein the over-center device includes a first element movably coupled to a second element, the method further comprising riding the first element upon a surface of the second element inclined with respect to the first element.

105. The method as claimed in claim 98, wherein the over-center device includes a first element movably coupled to a second element, the method further comprising riding the first element upon a surface of the second element as the second element rotates about an axis.

106. The method as claimed in claim 98, wherein actuating the lever includes pivoting the lever about a pivot point.

107. The method as claimed in claim 106, wherein moving the lever includes moving the pivot point with respect to the pawl.

108. The method as claimed in claim 106, wherein the pivot point is located in substantially the same position with respect to the lever in the first and second positions of the lever.

109. The method as claimed in claim 98, wherein the over-center device is biased toward at least one of the first and second stable positions and away from the center position upon movement of the over-center device to a corresponding side of the center position.

110. The method as claimed in claim 98, wherein:
the over-center device has a first element and a second element pivotably coupled to the first element and coupled to the lever;
the first element has a range of pivot positions with respect to the second element, the range of pivot positions including the center position; and
moving the over-center device includes pivoting one of the first and second elements with respect to the other of the first and second elements.

111. The method as claimed in claim 98, wherein:
the over-center device includes a first element pivotably coupled at a first pivot point to a second element and pivotable about a second pivot point;
the lever is pivotably coupled to the second element at a third pivot point,
the method further comprising moving the second pivot point across a line passing through the first and third pivot points, the line defining the center position of the over-center device.

112. The method as claimed in claim 98, wherein moving the lever includes camming the over-center device against the lever.

113. The method as claimed in claim 98, wherein moving the lever includes pivoting the lever with respect to the over-center device.

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